

What is claimed is:

- 1.. 'A continuously variable transmission apparatus comprising:
- an input shaft;
 - 5 an output shaft;
 - a toroidal type continuously variable transmission;
 - a differential unit comprising a plurality of gears;
 - and
 - a controller for changing a transmission ratio of the
 - 10 toroidal type continuously variable transmission,
 - wherein the toroidal type continuously variable transmission comprises:
 - an input side disk rotated by the input shaft;
 - an output side disk concentrically supported
 - 15 with the input side disk and rotatable relative to the input side disk;
 - a plurality of power rollers interposed between the input side disk and the output side disk;
 - a plurality of support members rotatably
 - 20 supporting the respective power rollers respectively; and
 - an actuator, for changing the transmission ratio between the input side disk and the output side disk, by displacing the respective support members, and
 - the differential unit comprises:
 - 25 a first input portion rotated with the input side disk by a rotation of the input shaft; and

a second input portion connected to the output side disk, wherein the differential unit transmits a rotation to the output shaft in accordance with a speed difference between the first and the second input portions, and

5 further comprising:

an input side rotation sensor for detecting a rotational speed of the input side disk; and

an output side rotation sensor for detecting a rotational speed of the output side disk,

10 wherein the controller controls the transmission ratio of the troidal type continuously variable transmission so as to change relative displacement speeds of the plurality of gears, thereby a rotational state of the output shaft is converted to regular rotation and reverse rotation, interposing a
15 stationary state, while the input shaft is brought into a state of being rotated in one direction,

the controller calculates a rotational speed of the output shaft, based on the rotational speed of the input side disk detected by the input side rotation sensor, the rotational
20 speed of the output side disk detected by the output side rotation sensor, and a gear ratio of the differential unit, and

if a no-running condition in which rotation of the input shaft is not transmitted to the output shaft is selected, the controller controls the transmission ratio of the toroidal
25 type continuously variable transmission, so that the rotational speed of the output shaft becomes null.

2. The continuously variable transmission apparatus according to claim 1, wherein the controller controls a torque transmitted through the toroidal type continuously variable transmission by changing the transmission ratio of the toroidal type continuously variable transmission.

3. The continuously variable transmission apparatus according to claim 2, wherein the controller controls the transmission ratio of the toroidal type continuously variable transmission in order to nullify the rotational speed of the output shaft, if a target value of the torque transmitted through the toroidal type continuously variable transmission is set to null.

15

4. The continuously variable transmission apparatus according to claim 1, wherein a signal for displacing the actuator in a state of nullifying the rotational speed of the output shaft is learnt and stored as a signal for stopping the output shaft while rotating the input shaft.

20

5. A continuously variable transmission apparatus comprising:

an input shaft;

25

an output shaft;

a toroidal type continuously variable transmission;

a differential unit of a gear type constituted by combining a plurality of gears; and

a controller for changing a transmission ratio of the toroidal type continuously variable transmission,

5 wherein the toroidal type continuously variable transmission comprises:

an input side disk driven to rotate by the input shaft;

10 an output side disk concentrically supported with the input side disk and rotatable relative to the input side disk;

a plurality of power rollers interposed between the input side disk and the output side disk;

15 a plurality of support members rotatably supporting the respective power rollers; and

an actuator, for changing the transmission ratio between the input side disk and the output side disk, by displacing the respective support members, and

the differential unit comprises:

20 a first input portion rotated with the input side disk by a rotation of the input shaft; and

a second input portion connected to the output side disk, wherein the differential unit transmits rotation to the output shaft in accordance with a speed difference between
25 the first and the second input portions, and

further comprising:

an input side rotation sensor for detecting a rotational speed of the input side disk; and

an output side rotation sensor for detecting a rotational speed of the output side disk,

5 wherein the controller converts a rotational state of the output shaft to regular rotation and reverse rotation by interposing a stationary state while the input shaft is brought into a state of being rotated in one direction, by changing relative displacement speeds of the plurality of gears
10 constituting the differential unit by controlling the transmission ratio of the toroidal type continuously variable transmission,

the controller controls a torque transmitted through the toroidal type continuously variable transmission by changing
15 the transmission ratio of the toroidal type continuously variable transmission within a mechanically limited range, and

if a no-running condition in which rotation of the input shaft is not transmitted to the output shaft is selected, the controller controls the transmission ratio of the toroidal
20 type continuously variable transmission, so that the torque transmitted through the toroidal type continuously variable transmission is set to a value other than null, and that a speed ratio between the input side disk and the output side disk calculated by detected signals of the input side and the
25 output side of rotation detecting sensors becomes a predetermined value.

6. The continuously variable transmission apparatus according to claim 5, wherein the controller learns and stores a signal, for displacing the actuator in a state in which the transmission ratio of the toroidal type continuously variable transmission is controlled such that the speed ratio between the input side disk and the output side disk becomes the predetermined value, as a signal for enabling to stop the output shaft while the input shaft is made to stay to be rotated.
7. The continuously variable transmission apparatus according to claim 1, further comprising a select lever at a driver's seat,
wherein, if the select lever is positioned at a parking range or a neutral range, the selection of the no-running condition is detected.
8. The continuously variable transmission apparatus according to claim 5, further comprising a select lever at a driver's seat,
wherein, if the select lever is positioned at a parking range or a neutral range, the selection of the no-running condition is detected.
9. The continuously variable transmission apparatus according to claim 1, further comprising:

a control valve, for changing the transmission ratio of the toroidal type continuously variable transmission, including a constituent member operated by an output rod of a motor and a spool of a pressure difference cylinder,

5 wherein a displacing direction of the constituent member, when the no-running condition is selected, is uniquely restricted.

10. The continuously variable transmission apparatus according to claim 5, further comprising:

a control valve, for changing the transmission ratio of the toroidal type continuously variable transmission, including a constituent member operated by an output rod of a motor and a spool of a pressure difference cylinder,

15 wherein a displacing direction of the constituent member, when the no-running condition is selected, is uniquely restricted.

11. The continuously variable transmission apparatus according to claim 9, wherein a feeding of a pressurized oil to a pair of pressure chambers constituting the pressure difference cylinder is restricted based on a displacement in an axial direction of the spool constituting a forward/rearward switch valve, and

25 a position in an axial direction of the spool is uniquely restricted by a spring included in the forward/rearward switch

valve in a state in which a hydraulic pressure is not introduced into the forward/rearward switch valve.

12. The continuously variable transmission apparatus according to claim 10, wherein a feeding of a pressurized oil to a pair of pressure chambers constituting the pressure difference cylinder is restricted based on a displacement in an axial direction of the spool constituting a forward/rearward switch valve, and

10 a position in an axial direction of the spool is uniquely restricted by a spring included in the forward/rearward switch valve in a state in which a hydraulic pressure is not introduced into the forward/rearward switch valve.

15